

HANDLING TRACKING AREA UPDATE REJECT WITHOUT EXTENDED DELAY

FIELD

[0001] An example embodiment of the present invention relates to the field of mobile wireless communication, particularly to signaling procedures involved in handling of tracking area update (TAU) reject without extended delay.

BACKGROUND

[0002] When multi-radio user equipment (UE) moves to long term evolution (LTE) (e.g. due to reselection procedure), and does not have Packet Data Protocol (PDP) context but has made a circuit-switched (CS) location update and optionally packet switched (PS) attachment to the operator network (NW), a problematic sequence follows. UE establishes a radio resource control (RRC) connection in order to do a tracking area update (TAU). The network (NW) rejects TAU due to the missing PDP context. Then an RRC connection release message is sent to UE. The UE RRC layer will start handling it but it will delay processing the message for 60 ms in order to send a confirmation of the message reception to the NW (via radio link control acknowledgement (RLC ACK)). That is when the NW knows that it can release UE contexts in the evolved Node B (eNB) handling the NW to UE link.

[0003] Immediately upon receiving the RRC release message, UE starts an ATTACH procedure in order to obtain PDP context, but because the RRC connection is being released, ATTACH fails. The failure is reported to the non-access stratum (NAS) layer. In the NAS layer, an ATTACH retry timer (T3411, 10 seconds) is started. The fixed 10 second retry timer causes a greater than 10 second delay in getting service in evolved universal mobile telecommunications service (UMTS) terrestrial radio access network (E-UTRAN).

BRIEF SUMMARY

[0004] In one embodiment, a method comprises receiving a downlink signal from a network entity indicating that a tracking area update (TAU) was rejected, receiving a downlink signal from a network entity commanding radio resource control (RRC) release, and beginning RRC release. The method may further comprise notifying non access stratum (NAS) that RRC release is ongoing, placing NAS into hold status while RRC release is ongoing, notifying NAS that RRC release is complete, issuing an Attach request from NAS when RRC release is complete, and beginning random access signaling to establish a communications link with a network entity.

[0005] In another embodiment an apparatus comprises at least a processor, a memory containing computer code instructions, said instructions when executed by the processor cause the apparatus to: process a downlink signal from a network entity indicating that a tracking area update (TAU) was rejected, process a downlink signal from a network entity commanding radio resource control (RRC) release, and beginning RRC release. The instructions, when executed by the processor, may further cause the apparatus to notify non access stratum (NAS) that RRC release is ongoing, place NAS into hold status while RRC release is ongoing, notify NAS that RRC release is complete, issue an Attach request from NAS when RRC release is complete, and begin random access signaling to establish a communications link with a network entity.

[0006] In another embodiment a computer program product comprises a non-transitory computer-readable medium with program code instructions stored therein, said instructions, with a processor, causing a mobile terminal to execute the steps: receiving a downlink signal from a network entity indicating that a tracking area update (TAU) was rejected, receiving a downlink signal from a network entity commanding radio resource control (RRC) release, and beginning RRC release. The instructions, with the processor, cause a mobile terminal to perform the steps: notifying non access stratum (NAS) that RRC release is ongoing, placing NAS into hold status while RRC release is ongoing, notifying NAS that RRC release is complete, issuing an Attach request from NAS when RRC release is complete, and beginning random access signaling to establish a communications link with a network entity.

[0007] In another embodiment an apparatus comprises means for receiving a downlink signal from a network entity indicating that a tracking area update (TAU) was rejected, means for receiving a downlink signal from a network entity commanding radio resource control (RRC) release, and means for beginning RRC release. The apparatus may further comprise means for notifying non access stratum (NAS) that RRC release is ongoing, means for placing NAS into hold status while RRC release is ongoing, means for notifying NAS that RRC release is complete, means for issuing an Attach request from NAS when RRC release is complete, and means for beginning random access signaling to establish a communications link with a network entity.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008] Having thus described example embodiments of the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

[0009] FIG. 1 is a schematic drawing of a mobile wireless network connection;

[0010] FIG. 2 is a schematic drawing of a mobile terminal;

[0011] FIG. 3 is Part 1 of a signaling diagram illustrating LTE reselection;

[0012] FIG. 4 is Part 2 of a signaling diagram illustrating LTE reselection;

[0013] FIG. 5 is Part 3 of a signaling diagram illustrating LTE reselection;

[0014] FIG. 6 is a revised Part 2 of the signaling diagram of FIG. 4 according to one embodiment of the invention;

[0015] FIG. 7 is flow diagram of the method embodiment of the invention.

DETAILED DESCRIPTION

[0016] Example embodiments of the present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all embodiments of the invention are shown. Indeed, the invention may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout.

[0017] As used in this application, the term “circuitry” refers to all of the following: (a) hardware-only circuit implementations (such as implementations in only analog and/or